

# LONGEVITY OF ADULT MALE *CALOSOMA SAYI* (COLEOPTERA: CARABIDAE) UNDER LABORATORY CONDITIONS<sup>1</sup>

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**ABSTRACT:** Ten adult male *Calosoma sayi* beetles, captured in early summer and maintained under laboratory conditions with food and water, survived an average of 115 days. The presence or absence of soil in the cage environment did not significantly affect the mean life span.

*Calosoma sayi* DeJean is an important predator on lepidopterous larval pests in agroecosystems of the southeastern United States (Price and Shepard 1978a). When this species has been brought into the laboratory, the cage environment for rearing, feeding, and longevity experiments typically includes a soil substrate (e.g. Burgess and Collins 1917). Recent experiments that have produced meaningful results utilized laboratory cages without soil (Price and Shepard 1978b, Young and Hamm in prep.) Since *C. sayi* adults are normally active on the soil surface and routinely burrow into the soil (pers. obs.), the effect of the absence of soil on experimental results becomes a relevant question. I chose to address this problem by considering the effect of cage substrate on longevity. This parameter was likely to demonstrate possible differences since it represented a summation of many other parameters.

## METHODS AND MATERIALS

*Calosoma sayi* adult males were captured during the period 19 June to 3 July 1981 in a walk-in UV-light trap 6km NW of Tifton, Tift Co., Georgia. These individuals probably had overwintered as adults and were actively reproducing and dispersing (Price and Shepard 1978a). In the laboratory, they were maintained at ambient conditions (ca. 25°C, 75% R.H) and exposed to the local photoperiod. Ten male beetles were individually placed in 17 x 12 x 6cm clear plastic containers with tight-fitting lids. A sheet of paper toweling cut to cover the entire bottom was placed in five of the containers. The other five containers were packed to a depth of three centimeters with soil from the agricultural fields surrounding the light trap where the beetles were captured. At 3-5 day intervals for the next 170 days, each container was opened, food debris removed, condition

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<sup>1</sup>Received May 30, 1984. Accepted August 11, 1984.

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of the beetle determined, the paper towel replaced or the soil surface smoothed and repacked, fresh food added, and a water mist added if necessary to maintain high moisture levels. The food utilized initially was an assortment of live and dead fall armyworm [*Spodoptera frugiperda* (J.E. Smith)] larvae, pupae, and adults. Observations during the first 45 days post-capture indicated that *C. sayi* preferred fall armyworm larvae. Consequently, 2-4 fifth instar (ca. 30mm) larvae killed by immersion in 80° C water were offered during each feeding period for the remainder of the experiment. Time of death for a beetle was considered to be the mid-point between the last day seen alive and the first day seen dead. Beetles were dissected at death to determine a possible cause of mortality.

## RESULTS AND DISCUSSION

When this experiment was terminated on 15 December, two beetles were still alive and active, one on each substrate type (Table 1). The mean longevity for all ten males was 114.7 days, with no significant difference in mean longevity between the groups of five beetles on each type of substrate (t-test,  $P > 0.9$ ). Dissection of beetles after death provided no evidence of pathogen-induced mortality. Under the given experimental conditions, the presence or absence of container soil thus appears to have minimal impact on the longevity of male *C. sayi*.

Values obtained in this experiment without soil are similar to those obtained previously when *C. sayi* was maintained on an exclusively larval fall armyworm diet (Young in prep.), suggesting that the variable diet

Table 1. Longevity of adult male *Calosoma sayi* with and without soil.

	Capture Date	Survival Post-capture	
<b>With Soil</b>			
#	1	29 June	>170 days*
	2	29 June	147
	3	29 June	120
	4	19 June	89
	5	19 June	61
			$\bar{x} = 117.4$ days
			$s = 39.1$
<b>Without Soil</b>			
#	6	3 July	>166 days*
	7	3 July	133
	8	25 June	107
	9	19 June	77
	10	19 June	77
			$\bar{x} = 112.0$
			$s = 35.4$

\*Experiment terminated on 15 December,

provided in the first 45 days had no positive or negative effect on subsequent longevity. The amounts of food provided each beetle appeared to be more than adequate, as some food remained after each feeding period. The possibility that *C. sayi* merely takes a long time to starve to death under these laboratory conditions regardless of diet has already been discounted, as death would usually occur within 29 days of capture if food was not provided (Young in prep.).

Considerable differences were observed in the behavior of beetles in the two substrate groups. Those individuals in the soil containers routinely burrowed in a corner at the start of each feeding period and stayed in it for most of each day and some of each night. Although feeding usually occurred on the soil surface, food items were sometimes dragged down the burrow and consumed. When on the soil surface, disturbances outside the containers would usually lead to rapid burrow descent. These behaviors were not possible in the containers without soil, but beetles in soilless cages consistently demonstrated much higher levels of locomotor activity.

Higher activity levels in containers without soil may be a function of light levels perceived by each beetle. All cages were in a rack that provided shade from laboratory and natural light during the day, with artificial light absent at night. Beetles in burrows under these lab conditions probably detected a minimal amount of light during the day, whereas beetles without soil were in atypically high daytime light levels. Since *C. sayi* is diurnally phototoxic negative as an adult (Price and Shepard 1978b), these high daytime light levels may have triggered increased activity related to avoiding light and searching for non-existent burrowing sites.

The observed difference in activity levels between the two substrate groups suggested that individuals in the more active group — without soil — would die sooner than those in the less active group. The fact that this did not occur suggests that food intake was adequate to allow increased activity without detrimental effects, and that *C. sayi* males possess considerable adaptability to environmental conditions.

The successful laboratory maintenance of a predatory ground beetle such as *C. sayi* for long periods of time without soil may be important for certain types of investigations. Studies in which photography is required are made easier if colored paper substrates are possible. Research that requires the frequent obtaining of body weights could be facilitated if soil was not present to adhere to body surfaces. Situations in which excreta must be observed and/or collected usually require the absence of soil. Since copulation, fighting over food and mates, predatory sequences, and other behaviors routinely occur in laboratory containers without soil (pers. obs.), for some investigations the additions of soil may only complicate the situation and make the observing and recording of behavioral events more difficult.

## ACKNOWLEDGMENTS

The technical assistance provided by Charon Sharp and Dr. John Hamm is appreciated, as is the manuscript review provided by G. Bernon, J. Hamm, and G. Snodgrass.

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## BOOK REVIEW

(Continued from page 26)

treated more completely than the remaining groups. SpHINGIDAE, Saturniidae and the noctuid genus *Catocala*, for example, receive almost complete coverage, while many other noctuids, geometers, and "micros" are omitted.

There are many excellent features of this field guide. All the plates are grouped together at the center of the book. Each plate is faced by a page of explanation of the numbered figures. At the top of each explanation page, the size of the moths as pictured on the plate is noted — an important feature for beginners. Most smaller species are represented life-size, larger are reduced a third or half as necessary. There is a single excellent color plate of larvae representing several families but especially Saturniidae. An editor's note by Roger Tory Peterson, and the preface prepared by the author convey something of the care and expertise that have gone into this work. Further chapters on how to use this book, moth anatomy, moth life cycle, collecting and preparing moths, classification of moths, a glossary, a bibliography and an index are excellent and self explanatory. As a field guide, this book follows their custom of giving primary emphasis to English or common names, the scientific name of each species appearing in italics and smaller typeface following the common name. The quality of both color and black and white plates is state of the art, and the former so excellent one wishes all plates could have been in color, but expense of this would put the book beyond the reach of many for whom it is primarily intended. Some of the black and white figures on some of the plates suffer importantly lacking color, but effort has been made to select species which in life are gray, black, and white for non-color illustration, and text description invariably mentions color, especially where diagnostic. No space is wasted — end papers illustrate structural parts, wing pattern and venation with excellent line drawings, and the last end paper shows silhouette shapes of moths of various families as they appear at rest in life. Unfortunately, the sphingid shown is mislabelled and should be *Paonias excaecatus*, not *Ceratonia undulosa*.

This field guide is a must for all beginners. Its' overall quality is immediately apparent, it fills a yawning gap in our field guide series, Peterson or other, and is long overdue. The quality of work and workmanship make it truly an ornament to the series, and hopefully it will soon become part of the library of everyone interested in its subject. The book is usual pocket size, easy to take afield, is a product of much careful research, reliable and beautifully produced. The author and all who helped him deserve our gratitude for producing, at an affordable price, a truly fine piece of work.

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